DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
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08 JAN 2002

DDESB-KT

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Changes to Alternate Test Procedures For Solid Propellant Rocket Motors

Reference: Department of Defense Ammunition and Explosives Hazard Classification Procedures (TB 700-2/NAVSEAINST 8020.8B/TO 11A-1-47/DLAR 8220.1) of 05 January 1998

The Department of Defense (DoD) alternate test procedures for solid propellant rocket motors have been revised as a result of deliberations involving the Service hazard classifiers, the DoD Explosives Safety Board (DDESB), Joint Army-Navy-NASA-Air Force propulsion industry representatives, and the Department of Transportation. Effective immediately, paragraph 6-6.*c.* of the reference procedures is replaced in its entirety with the attached text. Figures 6-9 and 6-10 are also replaced and a new Figure 6-11 is added. The new procedures offer several options for assessing rocket motor shock sensitivity in lieu of single package and stack testing. The external fire test requirement remains in the hazard classification testing protocol for rocket motors.

The DDESB point of contact regarding this matter is Mr. Brent E. Knoblett, DSN: 221-1375, Commercial: (703) 325-1375, Fax: (703) 325-6227, or E-mail: Brent.Knoblett@ddesb.osd.mil.

William E Wright

WILLIAM E. WRIGHT
Captain, US Navy
Chairman

Attachment
As stated

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6-6.*c*. Solid Rocket Motors. For solid propellant rocket motors, you may elect not to perform single package and stack testing. In that case, you can either submit an alternate test plan in accordance with paragraph 3-2.*g*. or conduct one of the three shock sensitivity tests below, followed by external fire testing. For large motors that are only transported singly, you may conduct the external fire test on a single article as it is configured for transportation, to include any packaging.

(1) Shock Sensitivity Test, Option 1

(*a*) Super Large-Scale Gap Test (SLSGT). Figure 6-9 presents a schematic of the SLSGT that shall be used. Preparation of the sample must be such that motor propellant is accurately represented. The witness plate shall not be placed directly on a rigid surface that would impede deformation of the plate. One test shall be conducted at a zero gap.

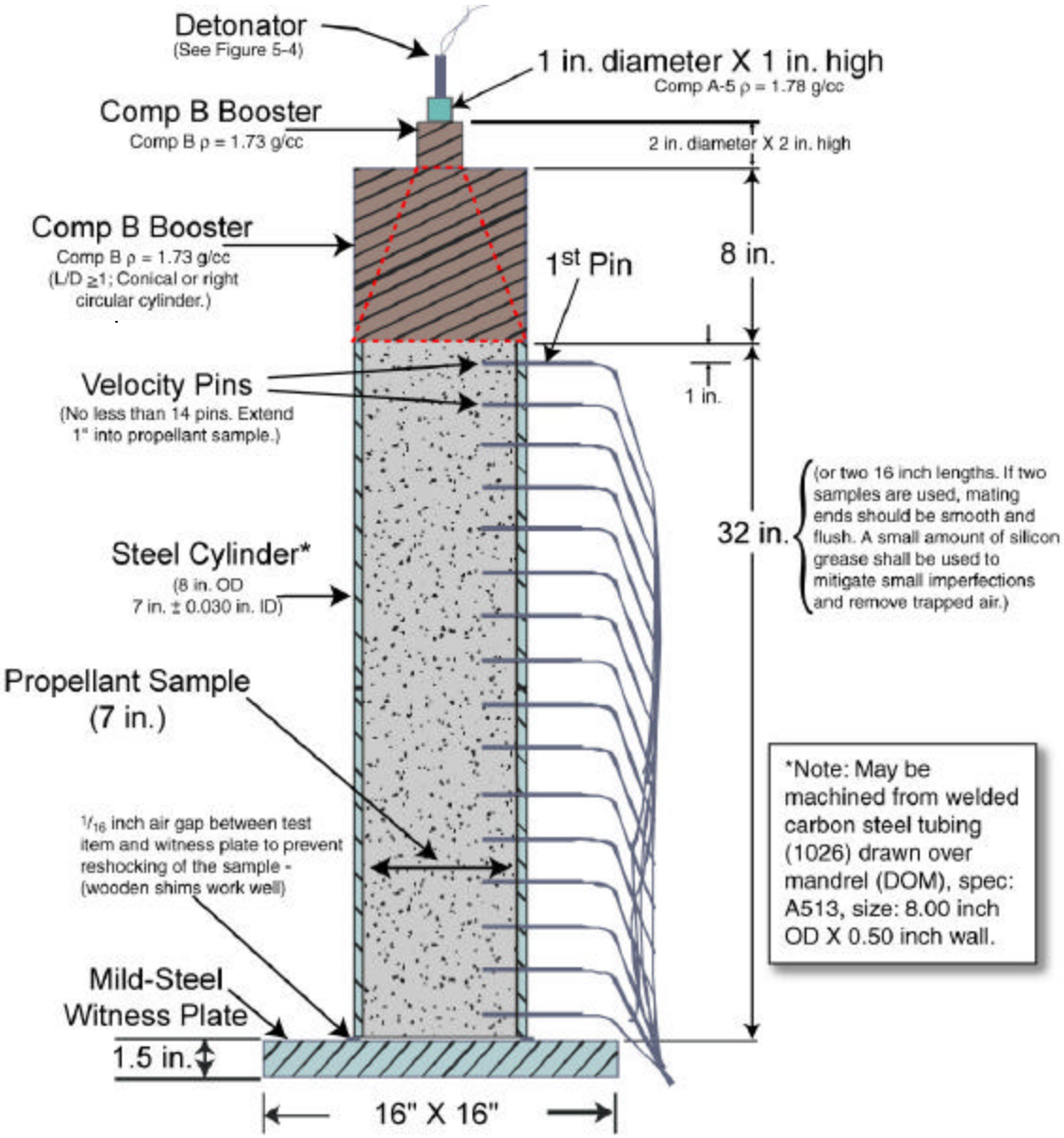

Figure 6-9. Super large-scale gap test configuration

1. Criteria: Propellants that maintain a stable detonation as evidenced by the velocity pins and the witness plate are hazard classified as HD 1.1. To be a HD 1.3 candidate, the propellant must exhibit a decaying reaction approaching sonic velocity. A hole in the witness plate or significant fracturing of the witness plate is evidence of HD 1.1.

2. Reporting Requirements: Test and sample set-up (diagram and photographs), propellant description (formulation, sample density), raw pin data, reaction velocity vs. pin distance plots, witness plate and recovered case fragment photographs. If available, also provide video/film records, and blast gauge data.

(2) Shock Sensitivity Test, Option 2

(*a*) This option requires that you first establish a sample size at or above Critical Diameter (CD) followed by 70 kbar shock sensitivity testing at or above one-and-a-half times that size.

(*b*) Unconfined Critical Diameter Test. This test provides data that will be used in determining the diameter for the following Gap Test. Figure 6-10 presents a schematic of the Unconfined Critical Diameter Test that shall be used.

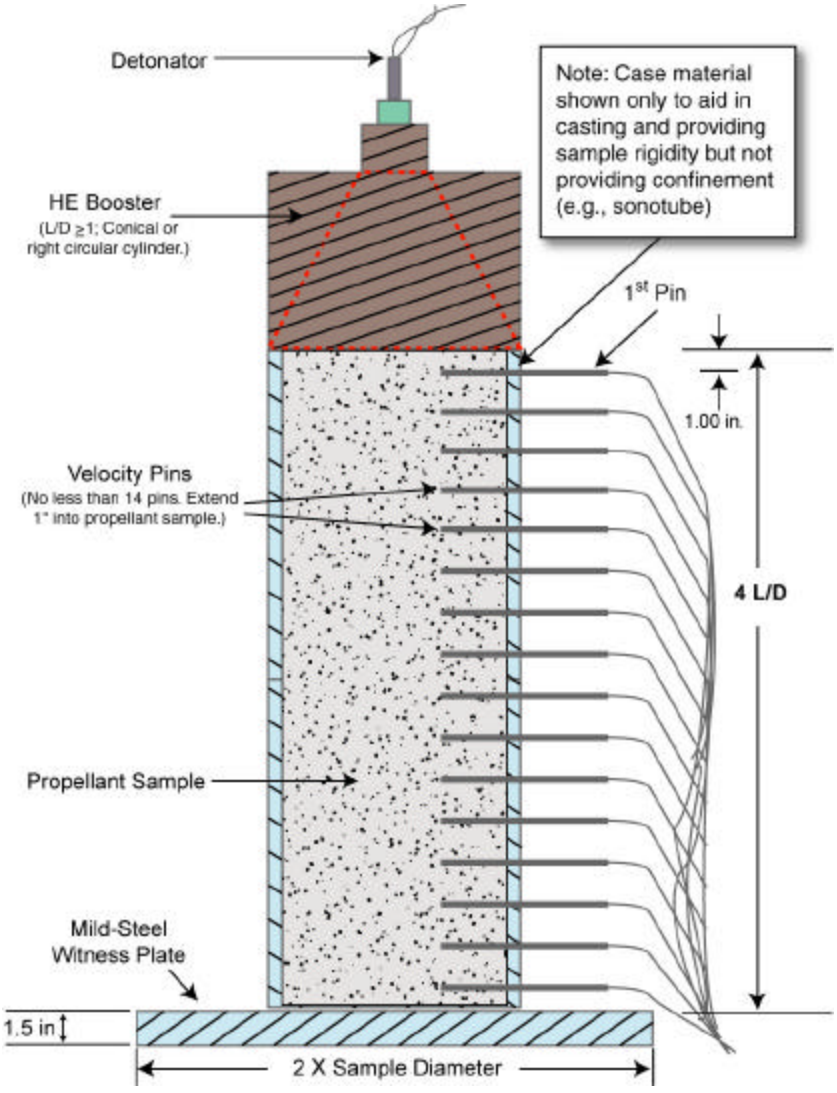

Figure 6-10. Unconfined critical diameter test configuration

Preparation of the sample must be such that motor propellant is accurately represented. The witness plate shall not be placed directly on a rigid surface that would impede deformation of the plate. One test shall be conducted.

1. Criteria: For any sample diameter at which a stable detonation occurs as evidenced by the velocity pins and the witness plate, that diameter is considered to be at or above CD.

2. Reporting Requirements: Test and sample set-up (diagram and photographs), booster material and configuration, propellant description (formulation, sample density), raw pin data, reaction velocity vs. pin distance plots, and witness plate photographs. If available, also provide video/film records, and blast gauge data.

(*c*) Gap Test. Figure 6-11 presents a schematic of the Gap Test that shall be used. Sample diameter shall be a minimum of 5 inches, or at least 150% of the unconfined critical diameter of the propellant (demonstrated as specified above), whichever is greater. Preparation of the sample must be such that motor propellant is accurately represented. The sample must be contained in a case that affords confinement equivalent to that of the rocket motor case. The witness plate shall not be placed directly on a rigid surface that would impede deformation of the plate. One test shall be conducted at 70 kbar shock pressure at the output end of the gap material (as input to the propellant sample under test).

1. Criteria: Propellants that maintain a stable detonation as evidenced by the velocity pins and the witness plate are hazard classified as HD 1.1. To be a HD 1.3 candidate, the propellant must exhibit a decaying reaction approaching sonic velocity. A hole in the witness plate or significant fracturing of the witness plate is evidence of HD 1.1.

2. Reporting Requirements: Test and sample set-up (diagram and photographs), propellant description (formulation, sample density), identification of booster material, booster/attenuator calibration, raw pin data, reaction velocity vs. pin distance plots, witness plate and recovered case fragment photographs. If available, also provide video/film records, and blast gauge data.

(3) Shock Sensitivity Test, Option 3

(*a*) Gap Test. Figure 6-11 presents a schematic of the Gap Test that shall be used. Sample diameter shall be that of the motor diameter. Preparation of the sample must be such that motor propellant is accurately represented. The sample must be contained in a case that affords confinement equivalent to that of the rocket motor case. The witness plate shall not be placed directly on a rigid surface that would impede deformation of the plate. One test shall be conducted at 70 kbar shock pressure at the output end of the gap material (as input to the propellant sample under test).

1. Criteria: Propellants that maintain a stable detonation as evidenced by the velocity pins and the witness plate are hazard classified as HD 1.1. To be a HD 1.3 candidate, the propellant must exhibit a decaying reaction approaching sonic velocity. A hole in the witness plate or significant fracturing of the witness plate is evidence of HD 1.1.

2. Reporting Requirements: Test and sample set-up (diagram and photographs), propellant description (formulation, sample density), identification of booster material, booster/attenuator calibration, raw pin data, reaction velocity vs. pin distance plots, witness plate and recovered case fragment photographs. If available, also provide video/film records, and blast gauge data.

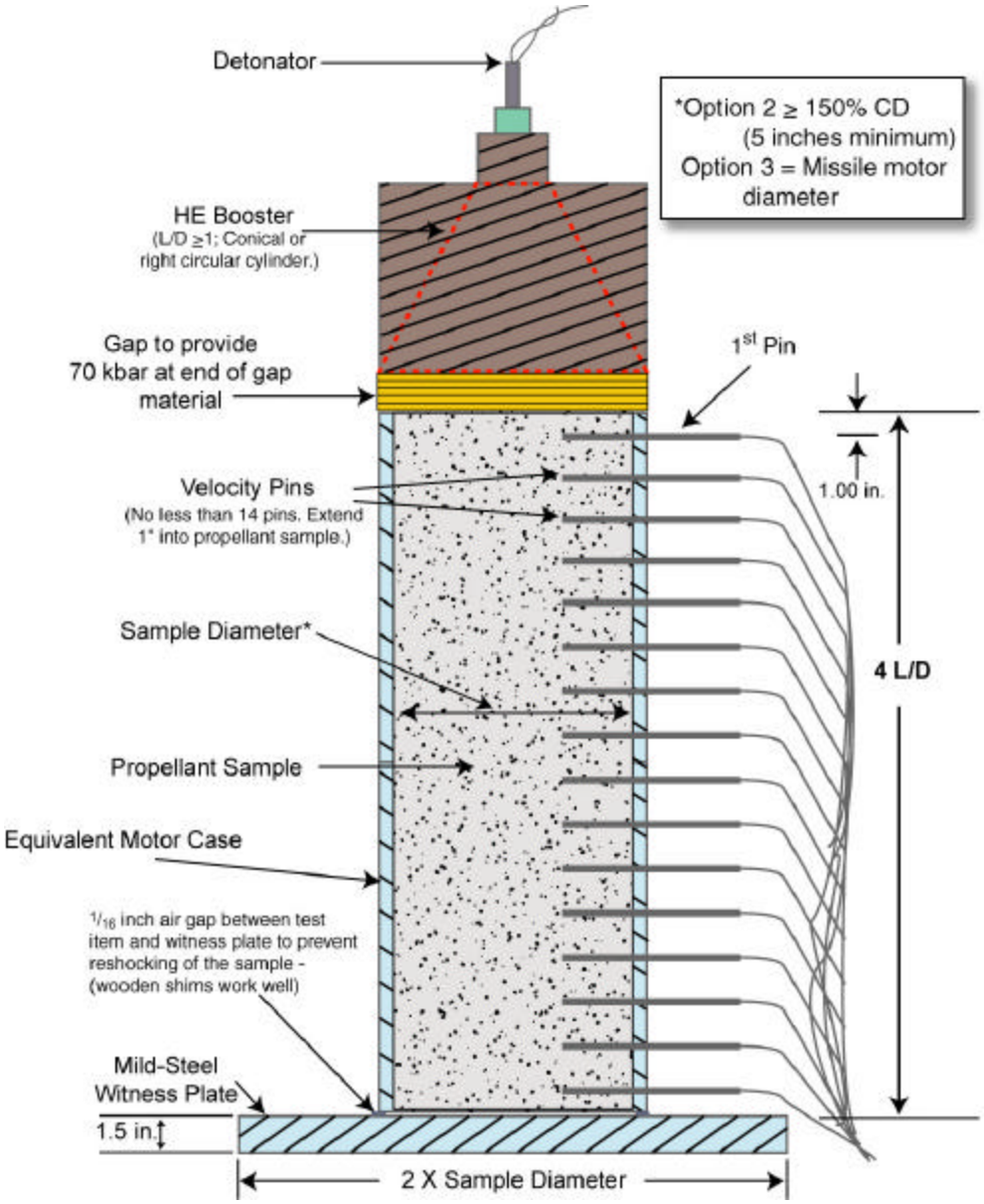

Figure 6-11. Gap test (³ 150% CD or Missile Diameter) configuration

(4) Any accident data arising during development that documents a motor's reactivity characteristics shall be included in the hazard classification data package.